

# Air pollution high at US public schools with kids from marginalized groups, new study finds

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Race- and ethnicity-based discrepancies in exposure to air pollution, especially regarding proximity to roadways and industrial zones, are well-

established. A new study reports the first nationwide patterns in atmospheric fine particulate pollution and nitrogen dioxide exposure at U.S. public schools.

On both national and local scales, schools with more students of color and students who receive free or reduced-price lunches, a proxy for poverty, are located in areas with higher concentrations of the pollutants, the study found. The study, led by members of NASA's Health and Air Quality Applied Science team, was published in *GeoHealth*.

The study analyzed the distribution of two pollutants, particulate matter of 2.5 microns in diameter and smaller (PM2.5) and [nitrogen dioxide](#), and compared pollutants to students' racial or [ethnic identity](#) and income status. PM2.5 can cause short-term irritation and exacerbate chronic conditions such as asthma and heart disease. Nitrogen dioxide can also cause irritation and either bring about or worsen respiratory conditions. Long-term exposure to both pollutants can result in increased risk of hospitalization or death.

"School kids are a really vulnerable population," said Michael Cheeseman, an atmospheric scientist at Colorado State University and lead author of the new study. "They're really sensitive to [air pollution](#), and they spend a lot of their time at [school](#)."

In the U.S., children spend an average of nearly 7 hours per day at school for 180 days of the year. School-aged children are also still developing, and studies have found exposure to air pollution may hurt children's health, including their brain development, lung health, and ability to learn, Cheeseman said.

The study used existing datasets of student populations across the continental U.S. and satellite-derived concentrations of the pollutants from 2017 through 2019, with pollutant estimations verified by

established EPA monitoring networks. One of the pollutant models explicitly accounts for nitrogen dioxide derived from traffic, which is especially relevant for low-income schools because they tend to be located near busy roadways. The pollutants reflect ambient air pollution, not air pollution inside school buildings.

"The biggest takeaway is that schools with higher proportions of students in racial or ethnic minorities, or that have higher poverty levels, tend to be associated with higher concentrations of PM2.5 and nitrogen dioxide," Cheeseman said. "These disparities exist from the national and state level even to local levels, with discrepancies and segregation within one city."

## **Regional differences in exposure**

Schools with higher proportions of minority students had about 30% higher peak concentrations of both nitrogen dioxide and PM2.5. The highest concentrations of nitrogen dioxide and PM2.5 are at schools where more than 80% of students are eligible for free or reduced lunch. The findings are consistent with previous studies that examined pollution and schools at smaller scales, such as school districts.

The researchers examined how air pollution discrepancies varied between states and between urban and [rural areas](#). To link pollution to population discrepancies, they considered how race/ethnicity and poverty varied by state and urbanicity. Urban schools experienced higher concentrations of nitrogen dioxide, likely due to proximity to high-traffic roads. Rural schools often had low nitrogen dioxide pollution, likely due to a lack of development, but PM2.5 exposure did not change much between rural and urban settings.

Regional differences in race and pollution exist. For example, in states in the South, schools tended to be more rural and have more Black and

African American students, so students at those schools are exposed to less nitrogen dioxide.

Because PM<sub>2.5</sub> has a longer lifespan in the atmosphere, it is more widely distributed and is therefore "smoothed out" over space and time, Cheeseman said, which could explain why stronger discrepancies exist for nitrogen dioxide than particulate pollution.

The factors included in the study—race or ethnicity, poverty and population density—are often related and influence each other. For instance, schools with higher proportions of racial or ethnic minorities tend to be in urban areas and have higher rates of poverty.

Although the EPA provides non-mandatory guidance on how to choose an appropriate location for a new school, there are currently no mandatory federal guidelines that protect students from attending schools in heavily polluted areas, the authors said.

"I do think more attention should be paid to this," said Cheeseman. "Placing a new school is probably a balancing act too, though. If you place schools in less polluted areas that are maybe farther out, students might need to commute through heavily trafficked areas longer, and they could be exposed to more pollution from traffic that way."

**More information:** Michael J. Cheeseman et al, Disparities in air pollutants across racial, ethnic, and poverty groups at US public schools, *GeoHealth* (2022). [DOI: 10.1029/2022GH000672](https://doi.org/10.1029/2022GH000672)

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